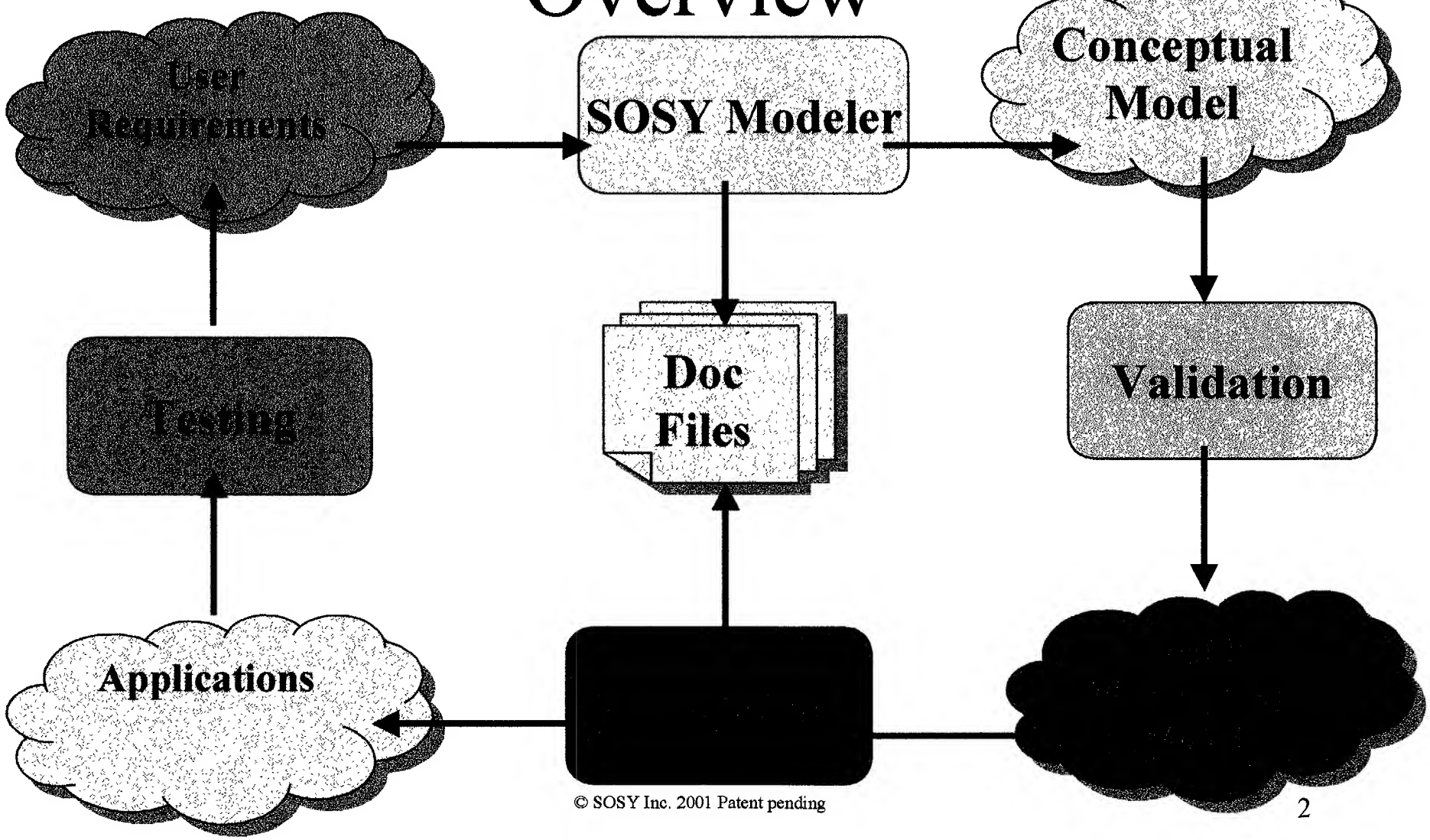
Summary

- Modeling
- Validation
- Documentation
- [illegible]
- Runtime Support
- User Interface

APPENDIX A

APPENDIX A

Overview



Conceptual Modeling Phase

CARE Technologies, S.A.

Index

- Intro
- Overview
- Phase 0. Requirements elicitation.
- Phase 1. Classes identification.
- Phase 2. Relationships between classes.
- Phase 3. Filling classes' details.

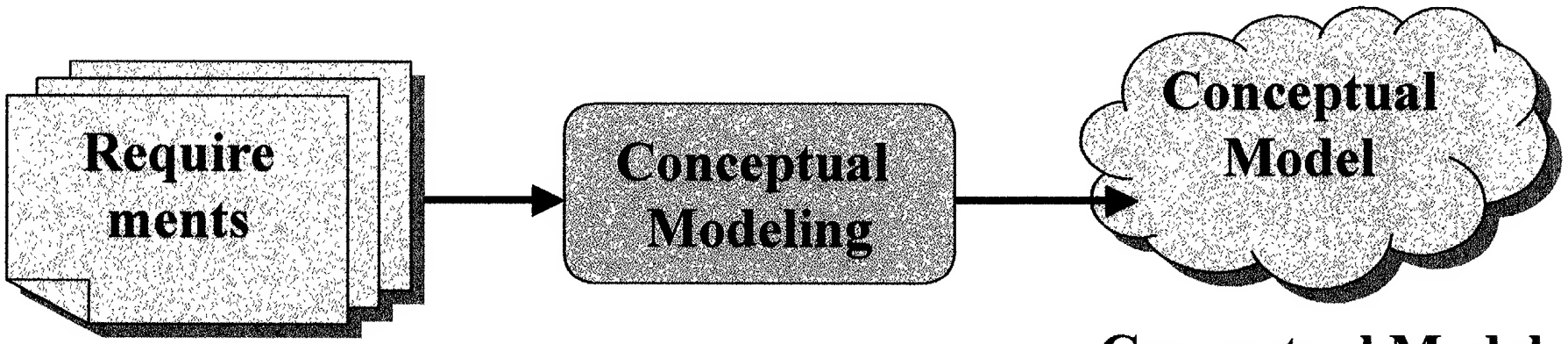
Index

- Phase 4. Express evaluations.
- Phase 5. Agent relationships.
- Phase 6. State Transition Diagram.
- Phase 7. Presentation Model.

Intro

- Conceptual Modeling Phase is a process of systematically & precisely description of the system to build, using:
  - Graphical UML compliant diagrams.
  - Constrains and semantics in a formal non-ambiguous language.
  - This phase is assisted by an integrated Modeler tool.

Overview



APPENDIX A

Requirements

- Specifications
- Documents
- Interviews
- Reports
- Other info. sources

Conceptual Model

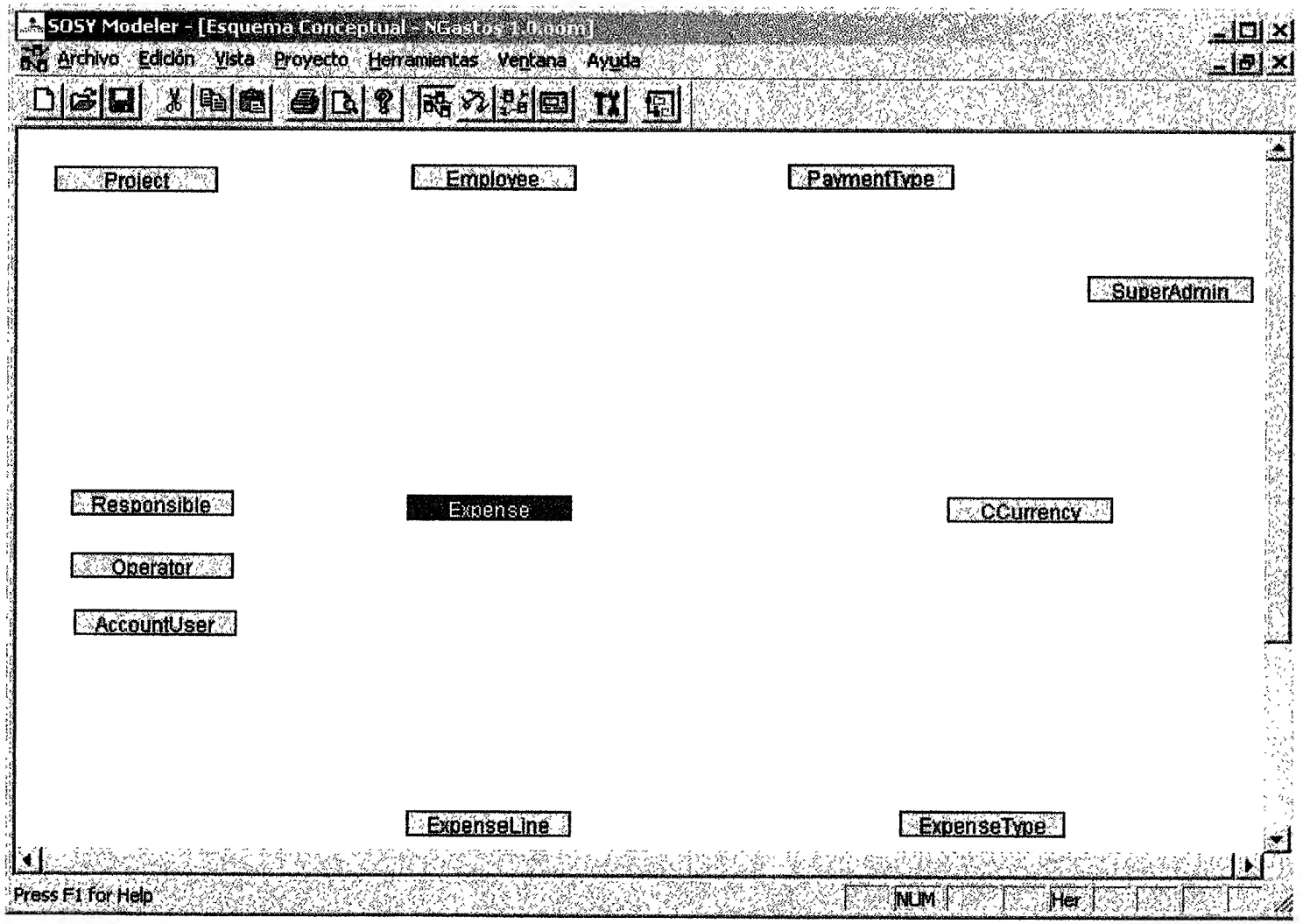
- Classes
- Relationships
- Attributes
- Services
- …

Expressed in a non-ambiguous language.

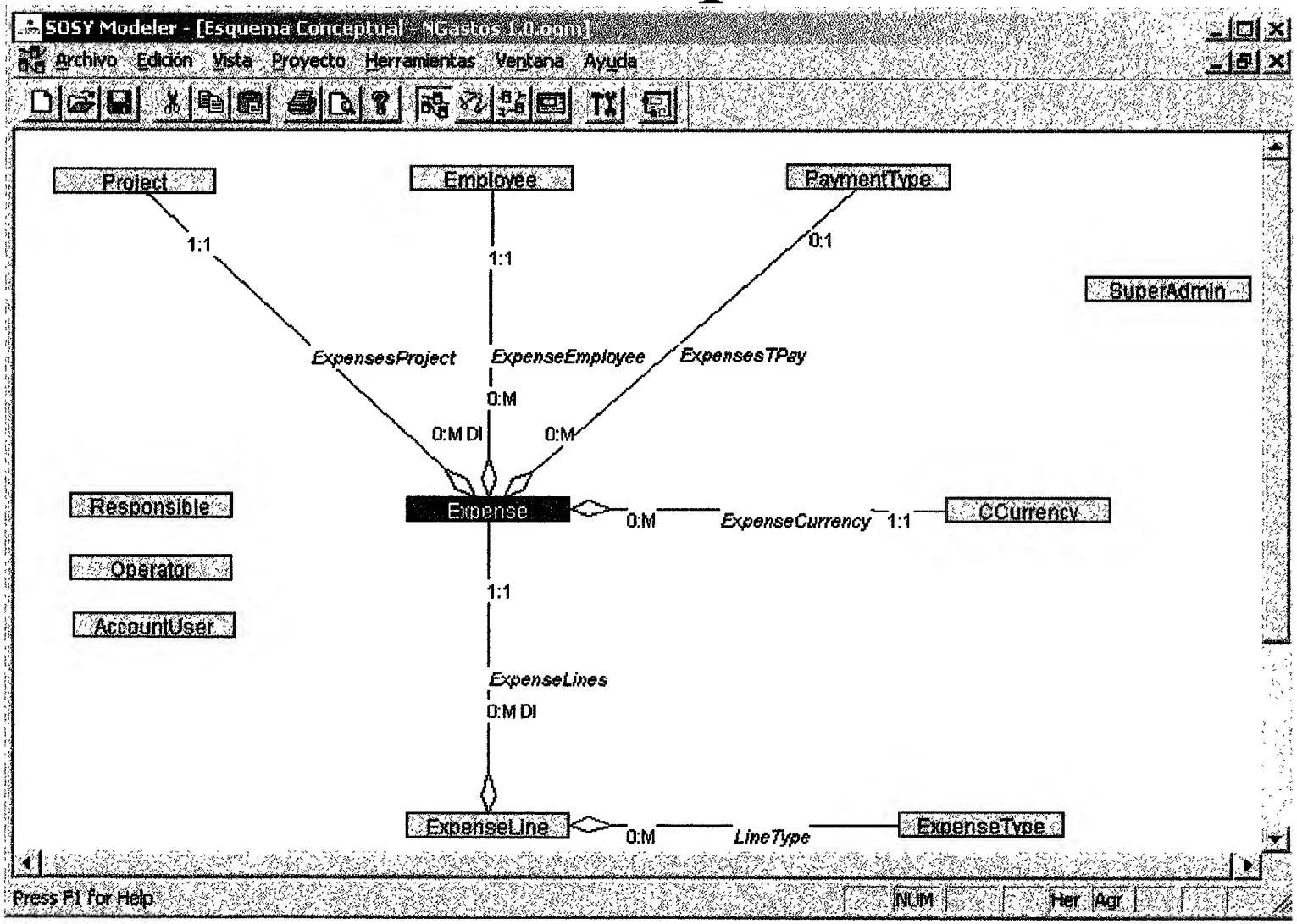
Phase 0. Requirement elicitation.

- Gathering the system requirements.
  - By meetings & interviews with customers, experts and final users.
  - By collecting reports, or documents expressing the system how-to and using tools.
  - Obtaining a coherent set of information as input to the next phase.

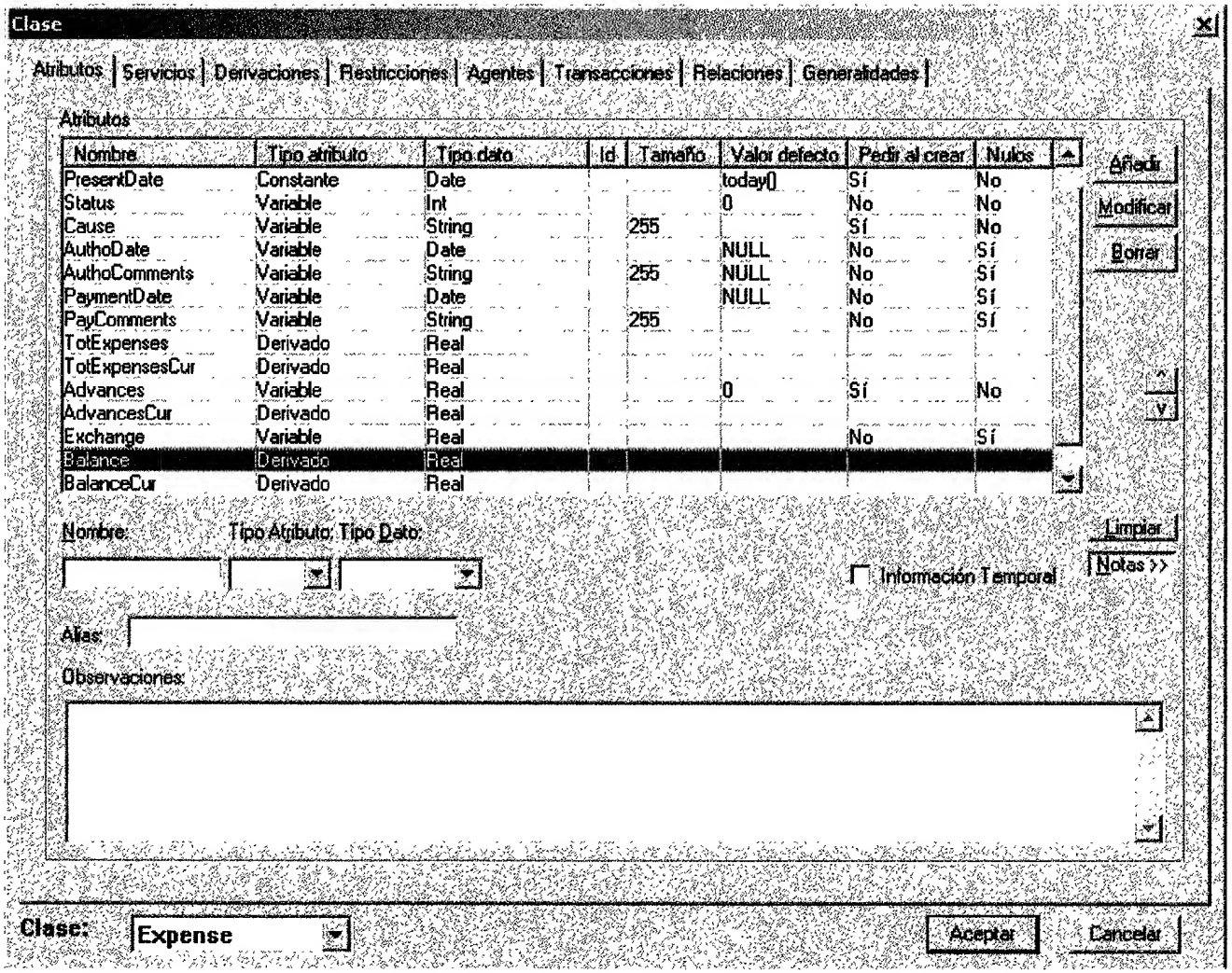
Phase 1. Classes identification.



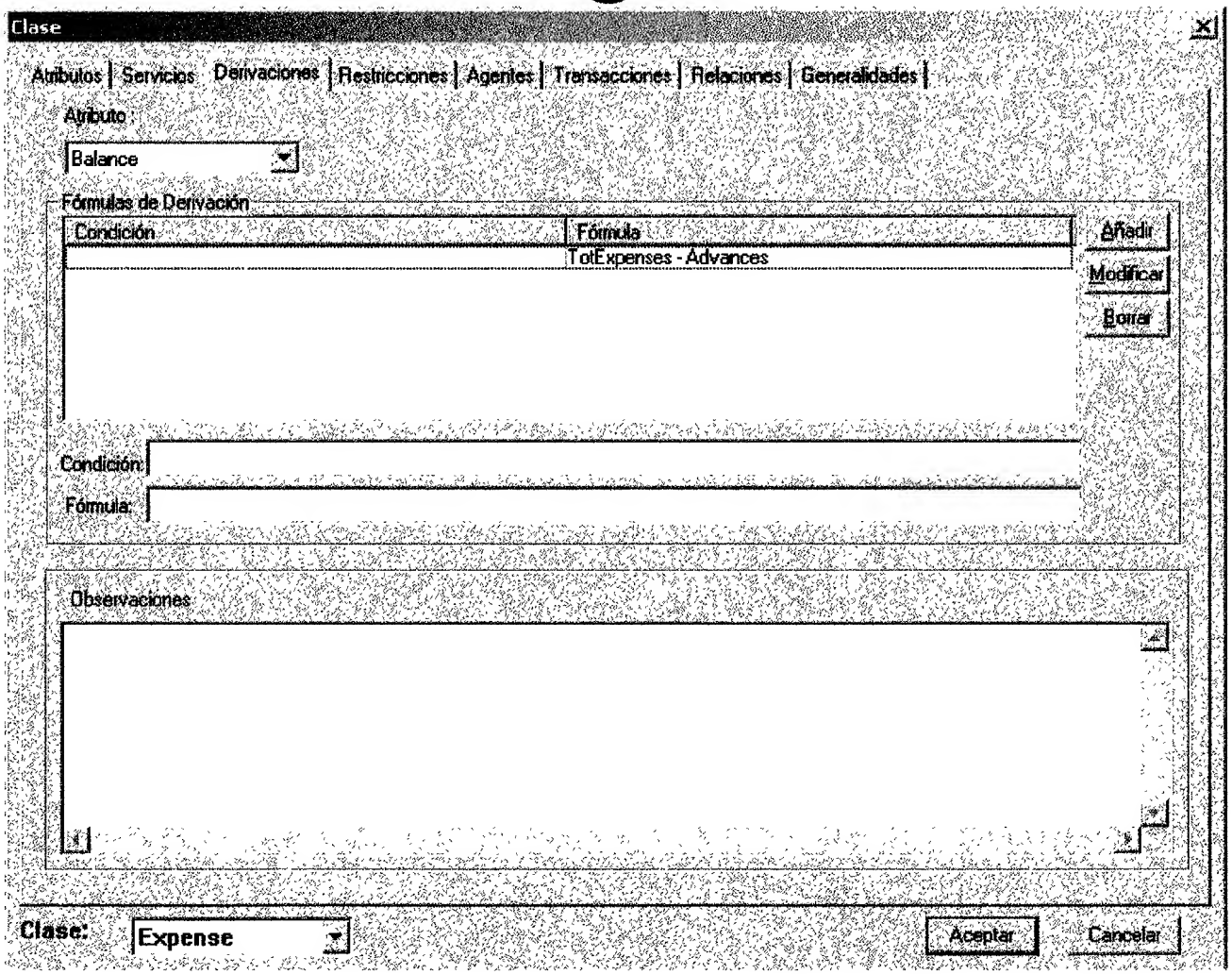
Phase 2. Relationships between classes.



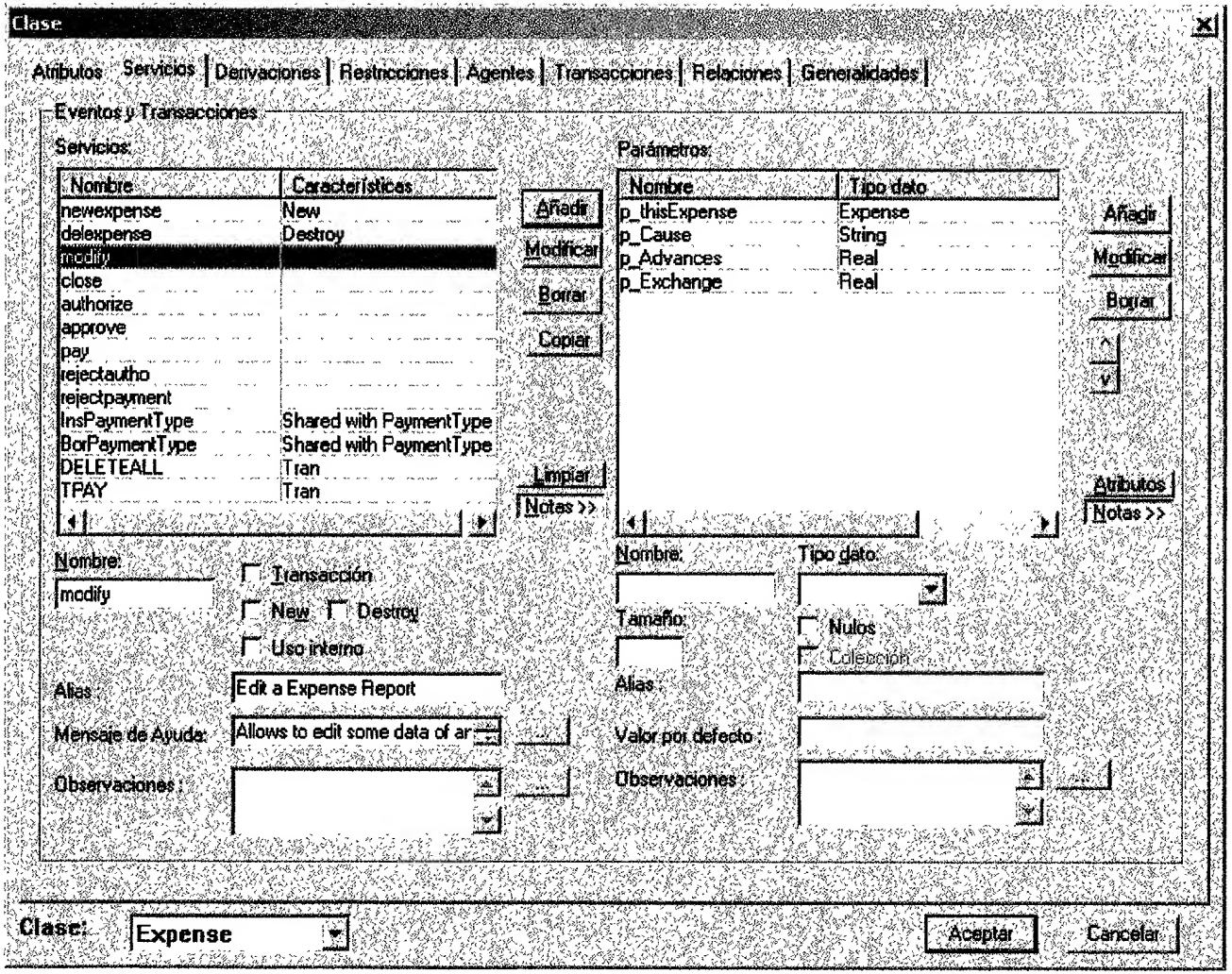
Phase 3. Filling classes' details.



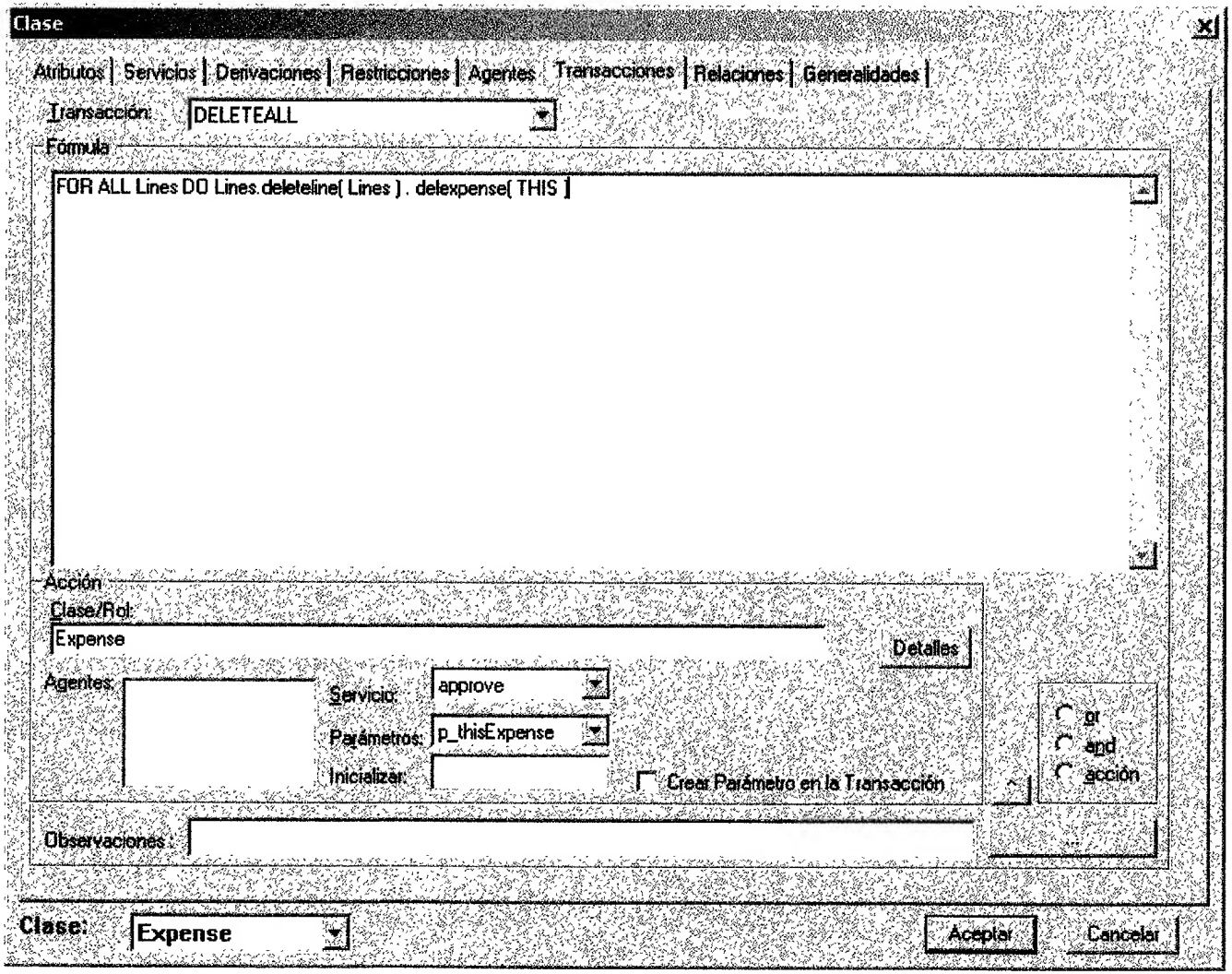
Phase 3. Filling classes' details.



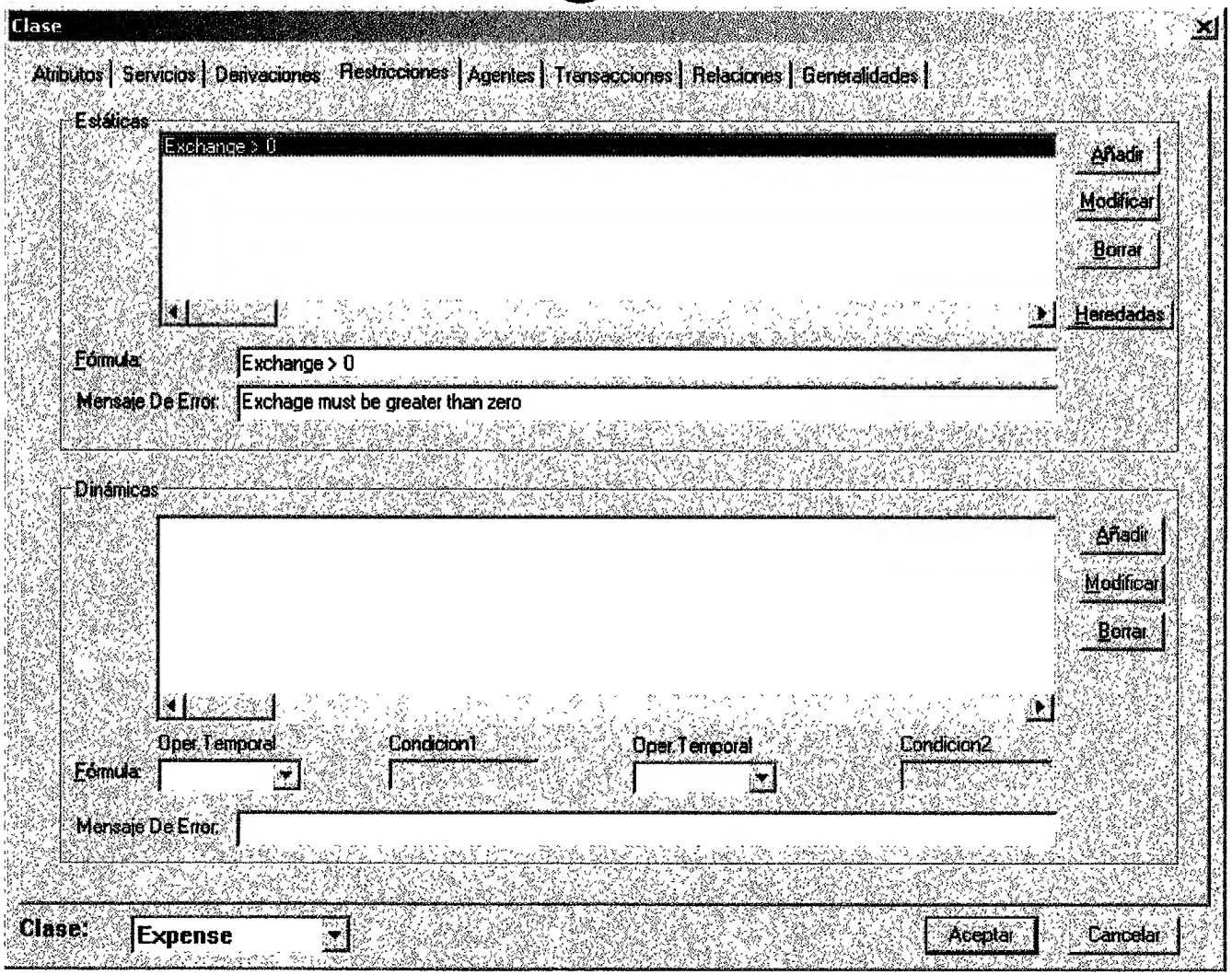
Phase 3. Filling classes' details.



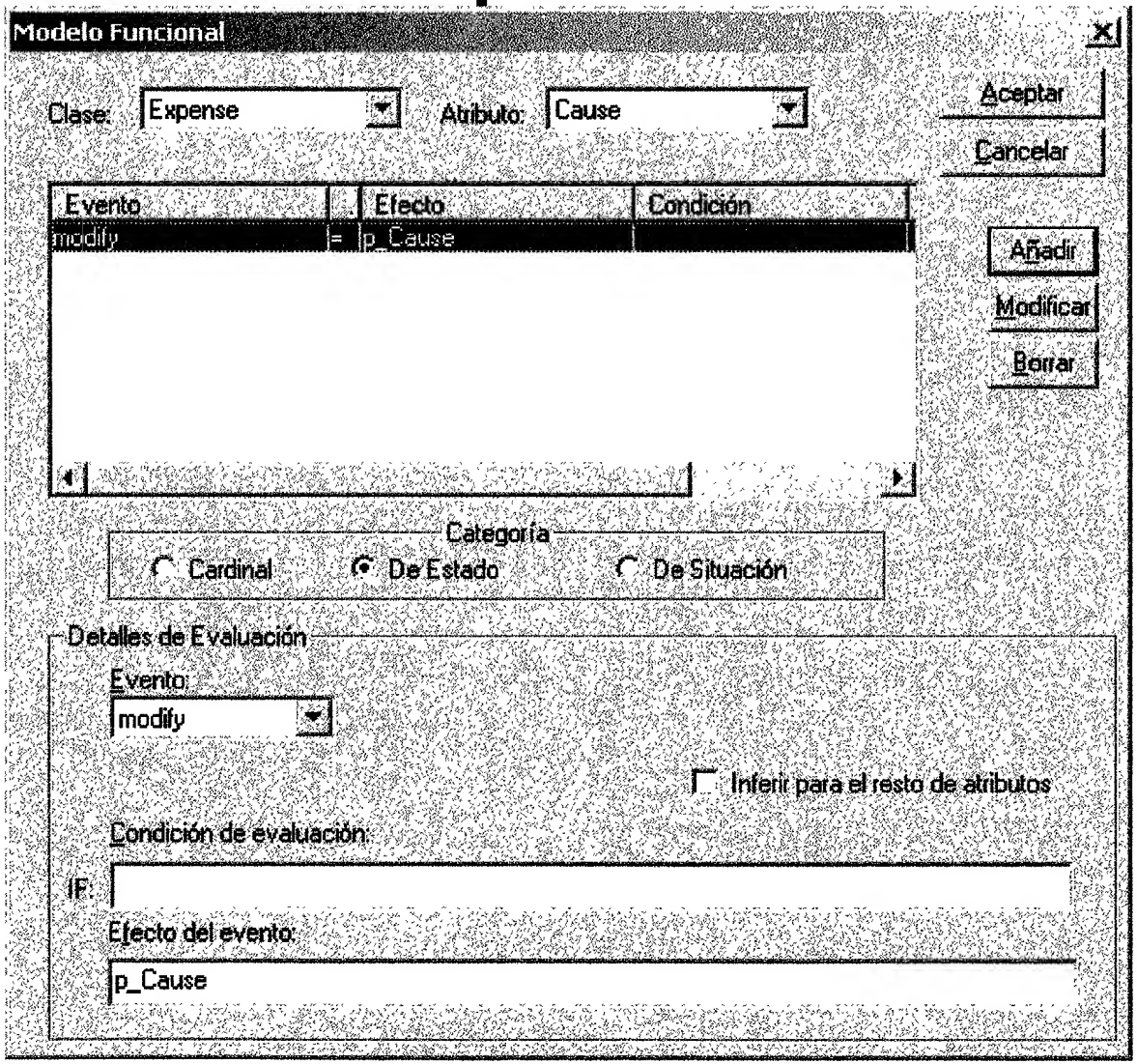
Phase 3. Filling classes' details.



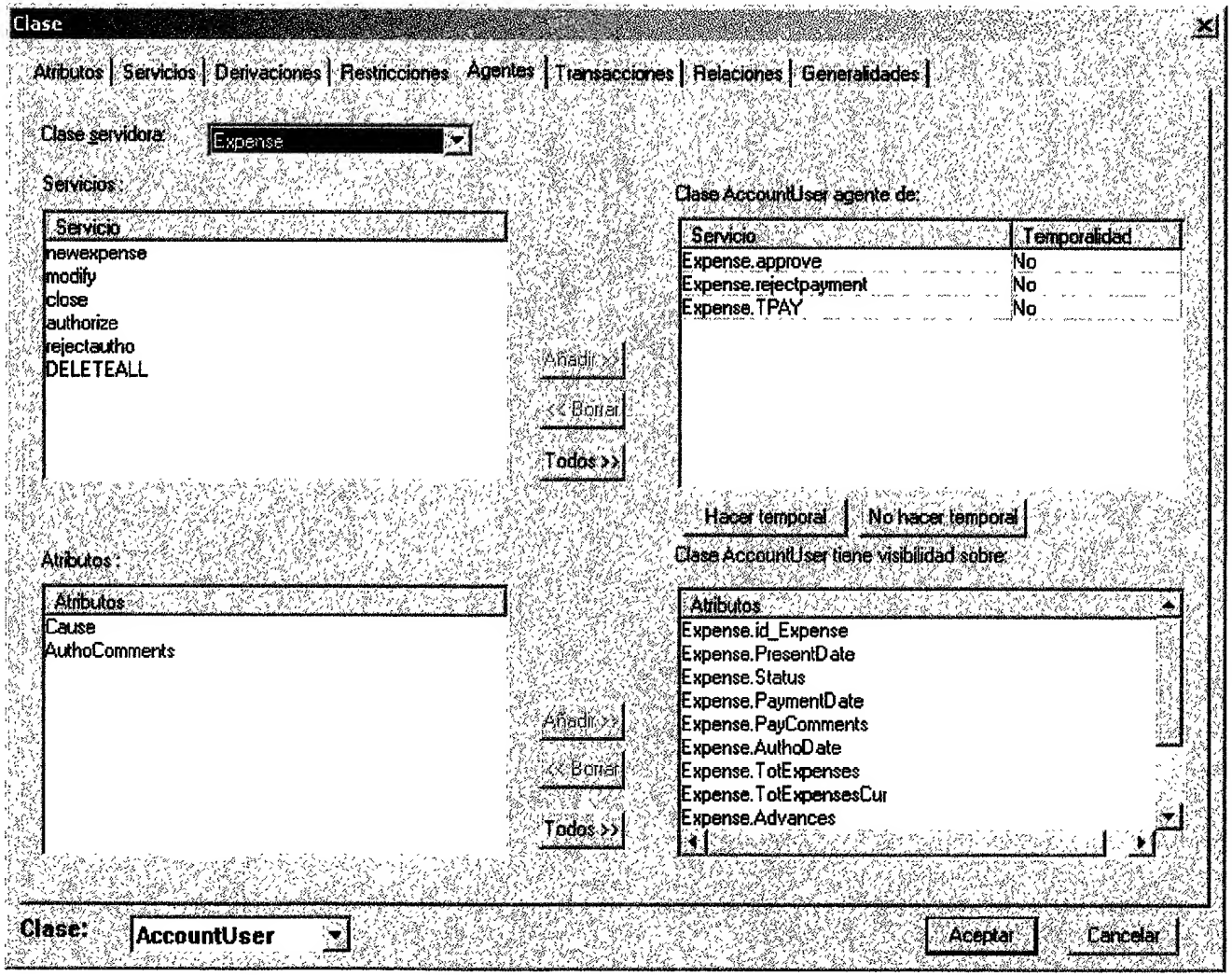
Phase 3. Filling classes' details.



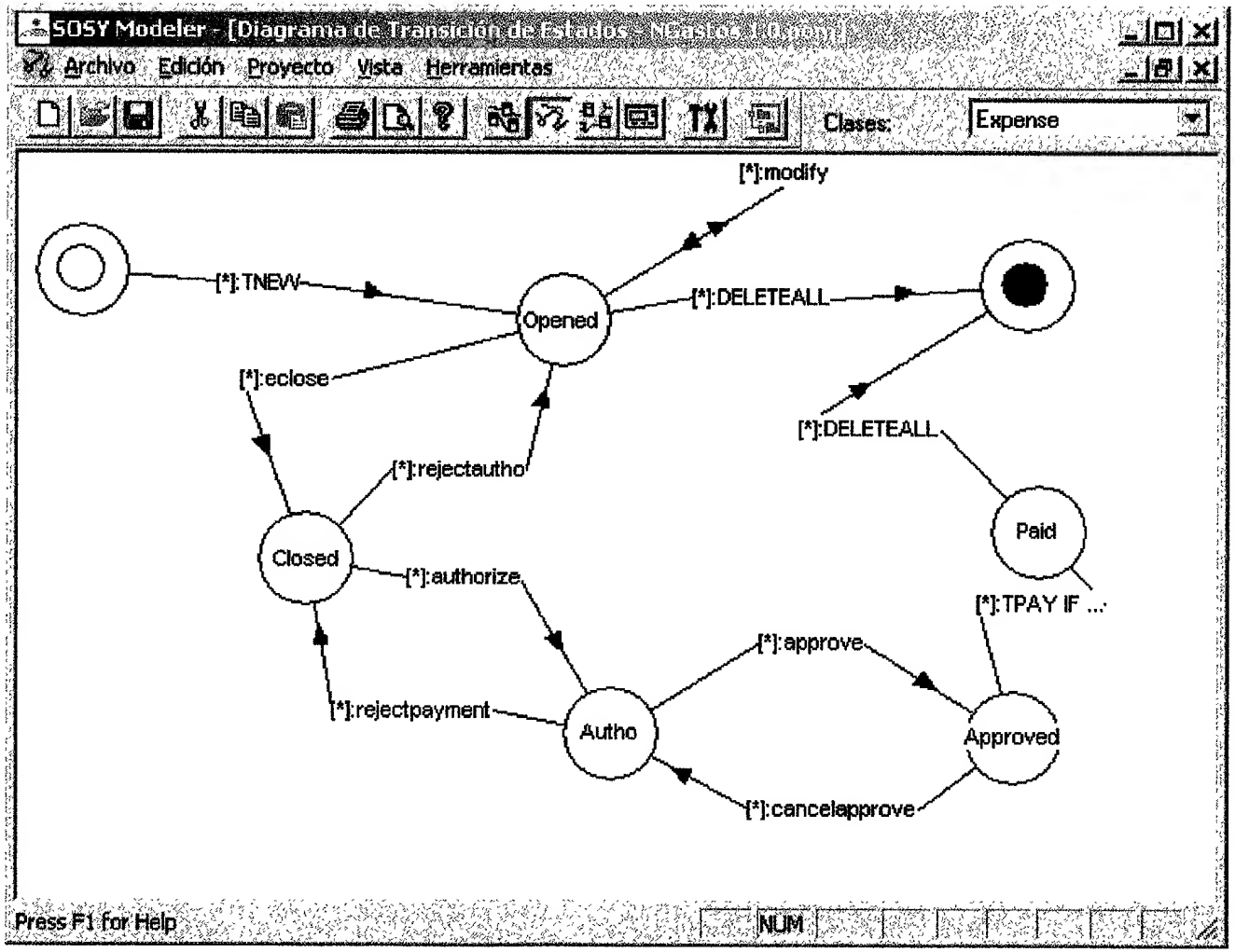
Phase 4. Express evaluations.



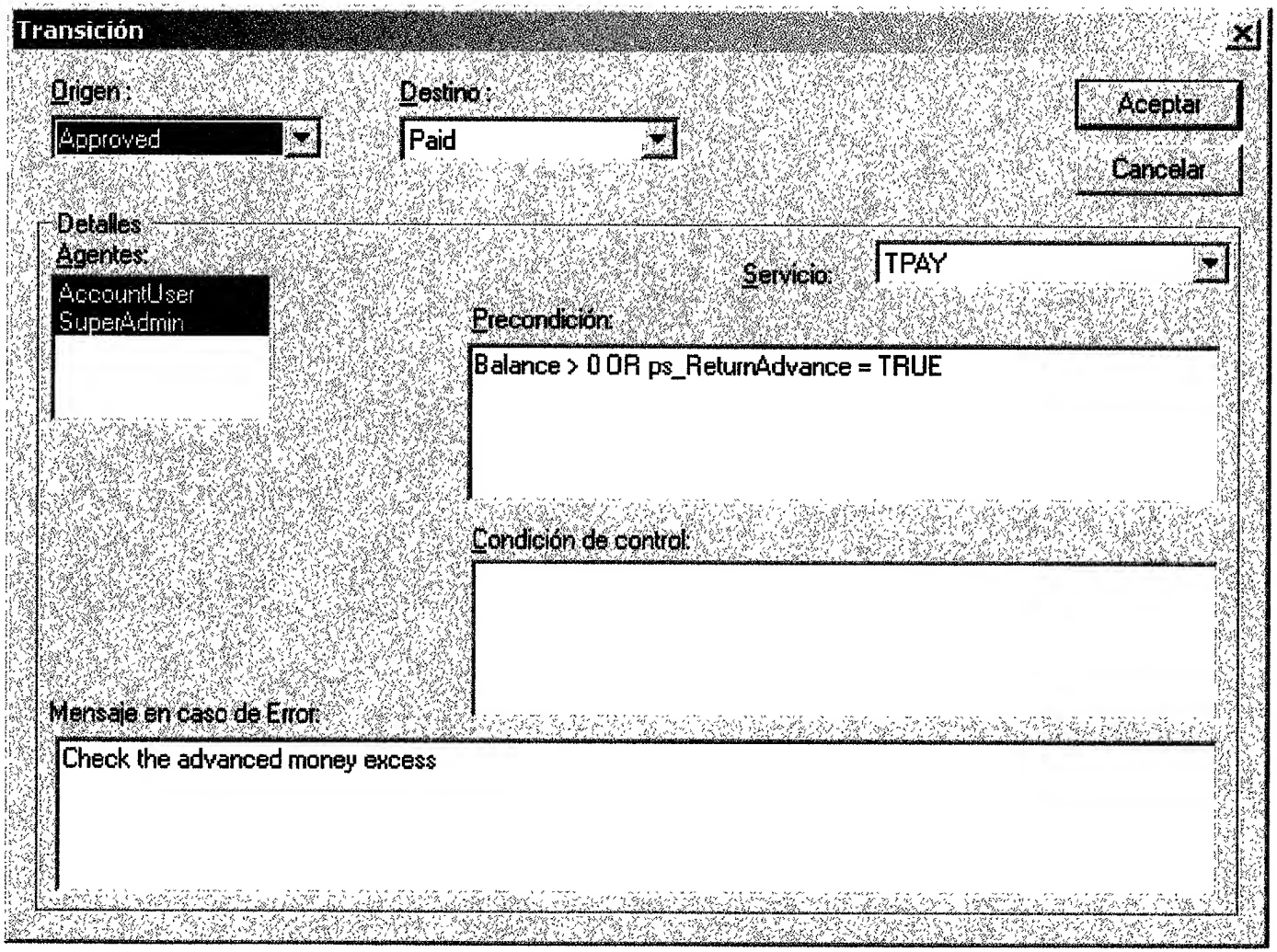
Phase 5. Agent relationships.



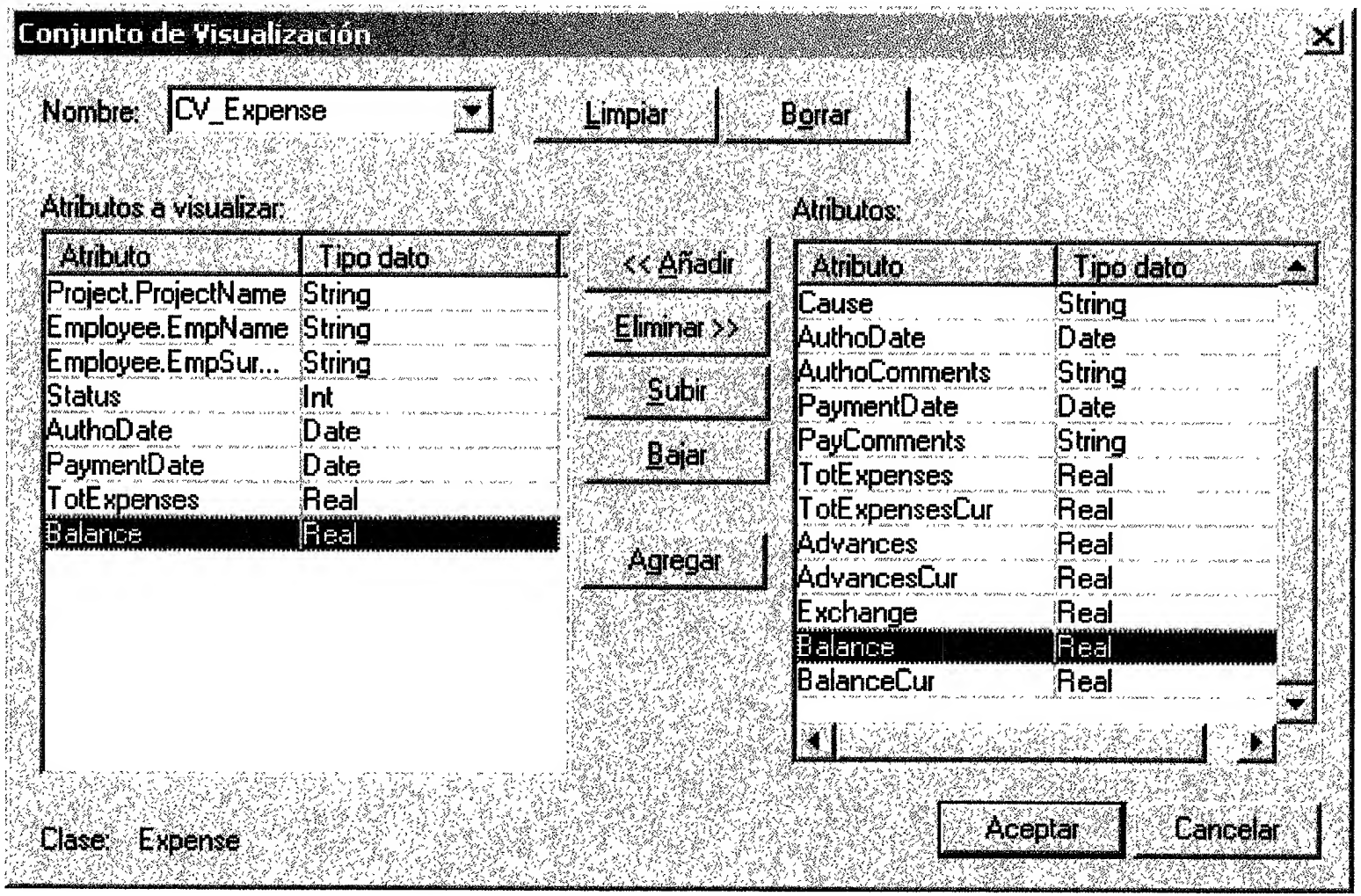
Phase 6. State Transition Diagram.



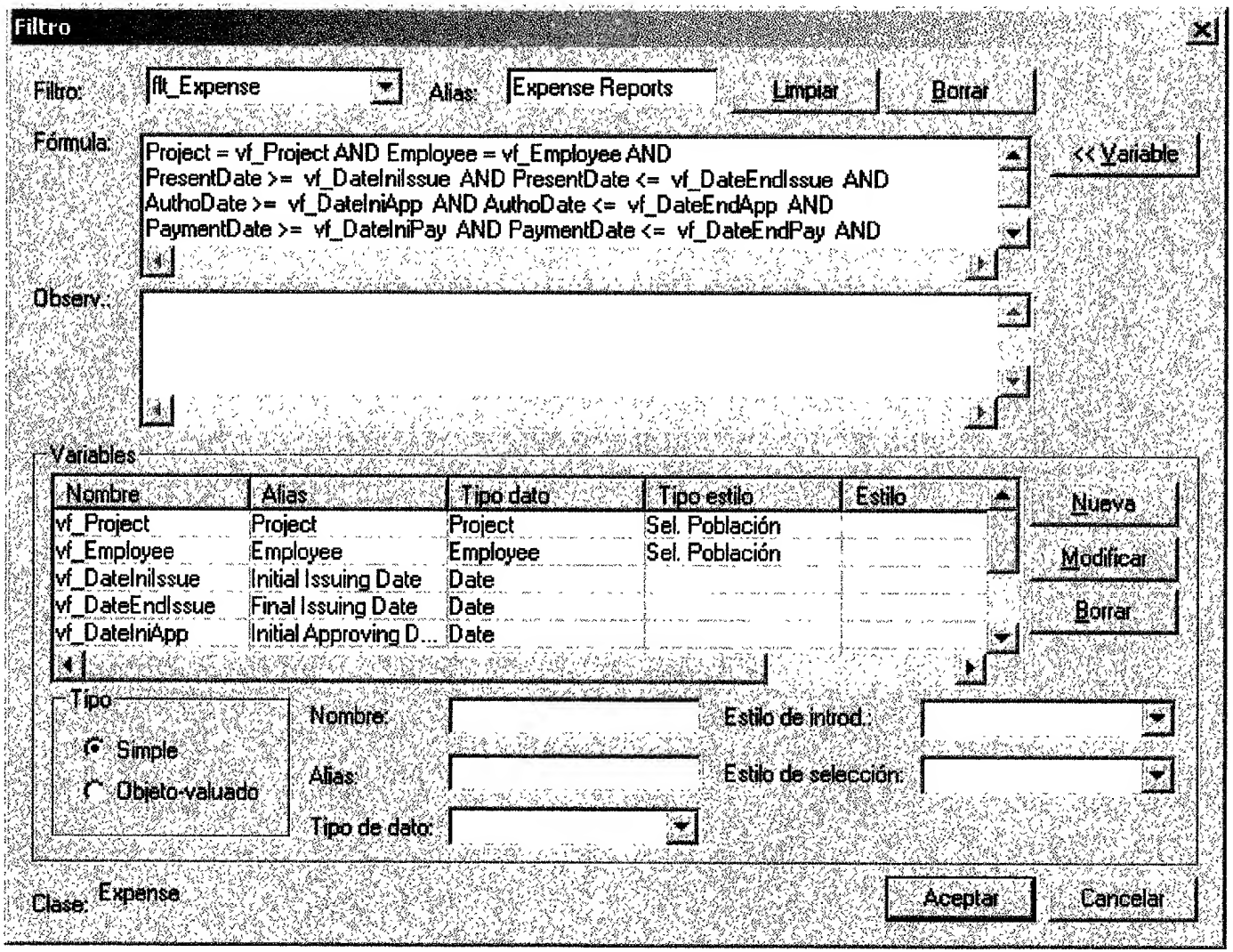
Phase 6. STD Preconditions



Phase 7. Presentation Model.



Phase 7. Presentation Model.



Conceptual Model Validation

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Index

- Intro
- Overview
- Validation Degrees
  - Partial Validation
  - Total Validation

Index

- Validation Types
  - Elements of the Conceptual Model
  - Formulas of the Conceptual Model (Syntax)
- Validation Trees
  - Nodes
  - Leaves
- Example

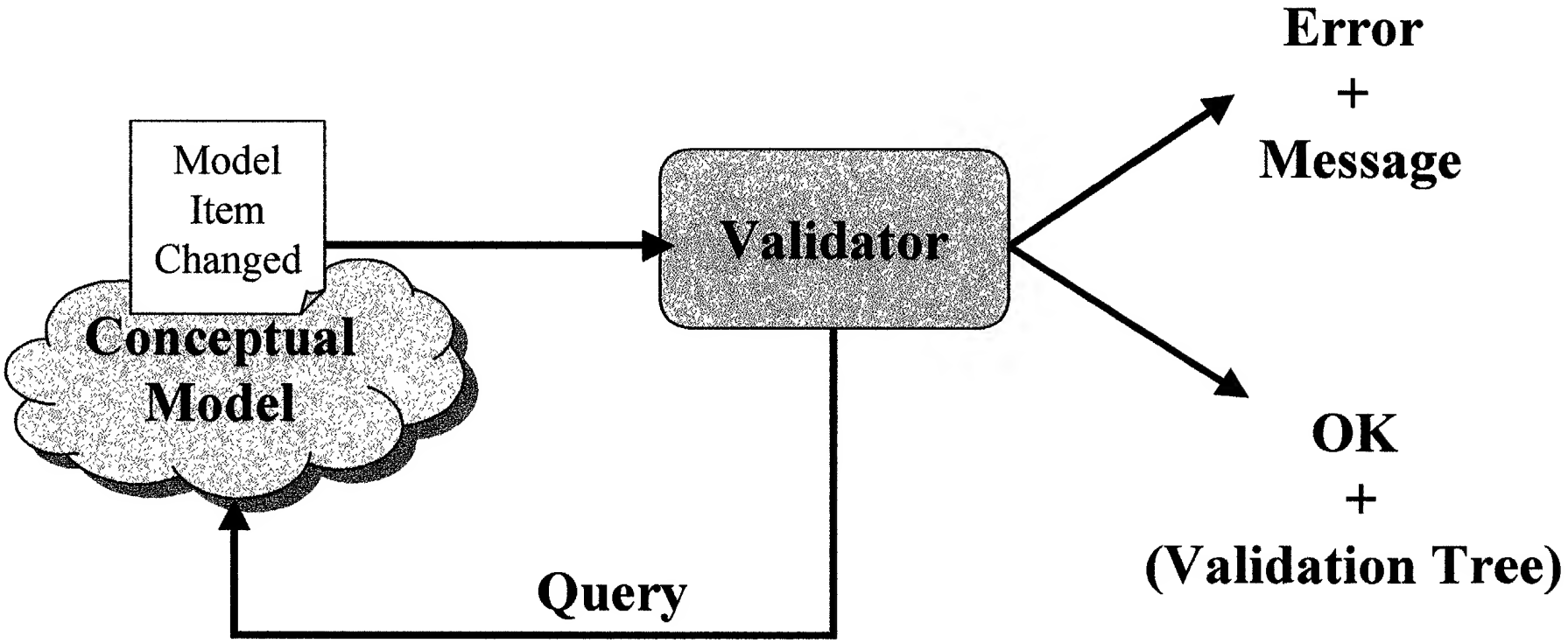
Intro

- Conceptual Model Validation is the process by which a conceptual model or a modification of it is proven to be valid:
  - Correct
    - Non Ambiguous
    - Non Contradictory
  - Complete
    - Every concept is fully specified
- Validation process checks the representation of requirements in Formal Specification Language to be valid

Validation Degrees

- Partial Validation
  - That of a single element of the Conceptual Model.
  - Happens whenever an element is added, modified or deleted.

Partial Validation Overview

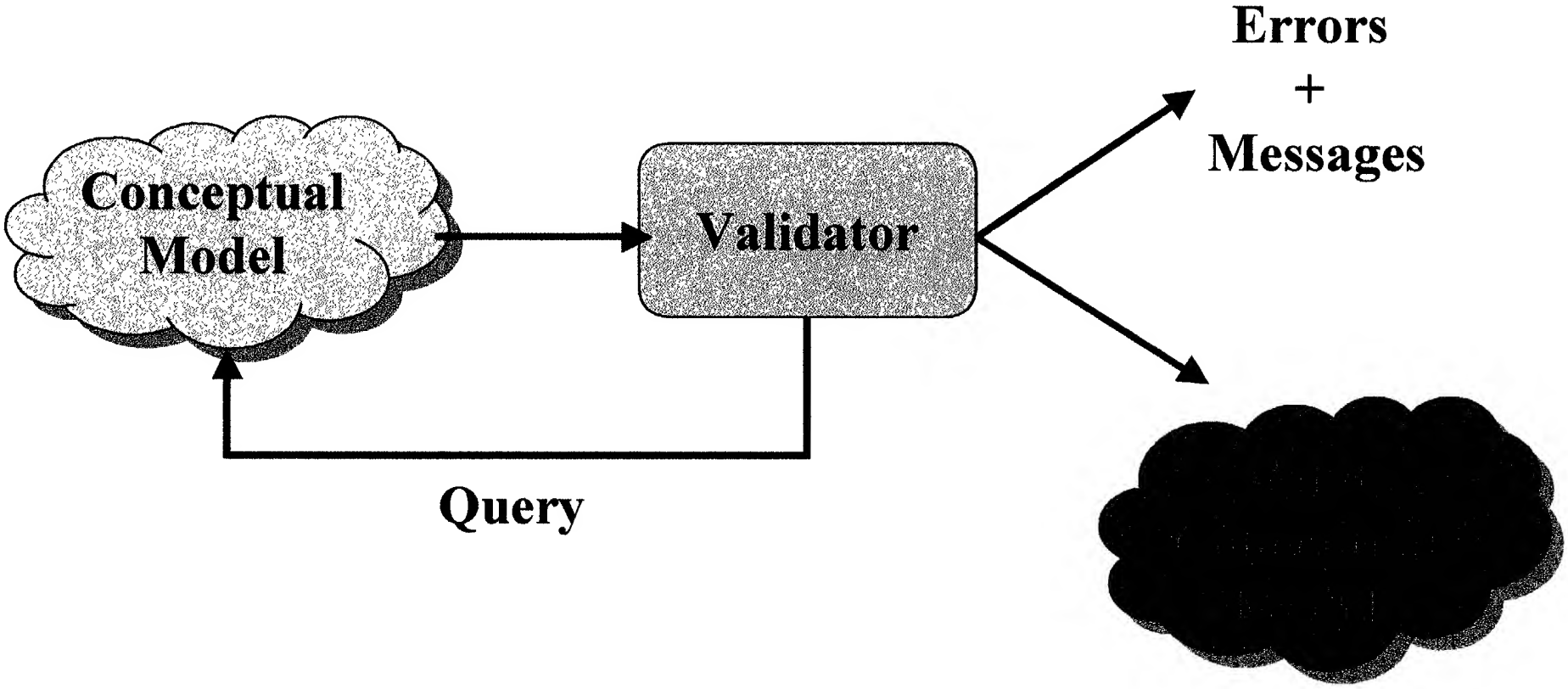


APPENDIX A

Validation Degrees

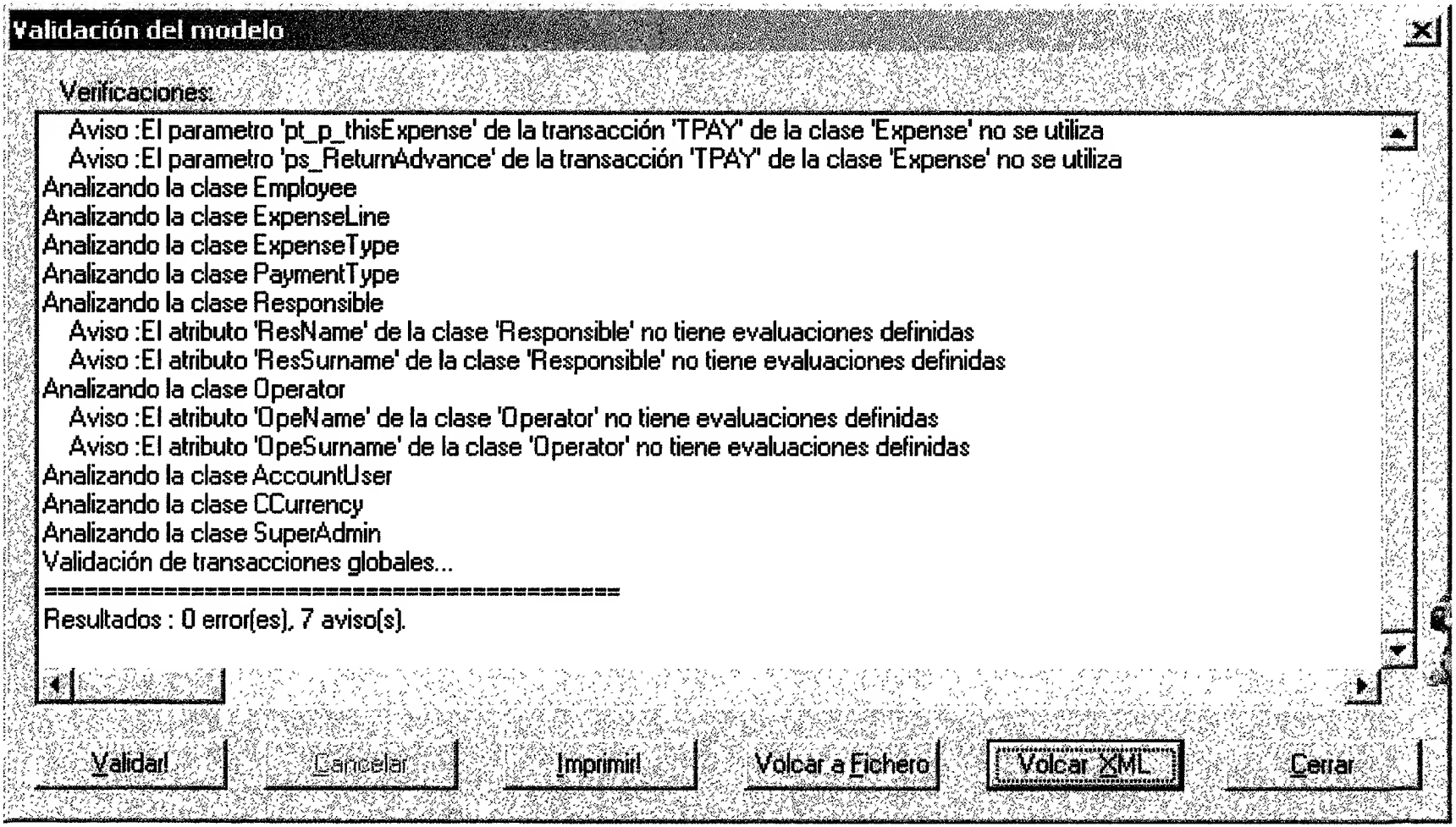
- Total Validation
  - That of the whole Conceptual Model.
  - Happens by request.
  - Must happen prior to any translation process.
  - Takes advantage of partial validations already performed.

Total Validation Overview



APPENDIX A

Total Validation Example



Validation Types

- Elements of the Conceptual Model
  - Ensure the properties of an element (except formulas) are correct and complete.
  - Conditions that must hold depend on the type of element and the property being validated.
  - Examples:
    - Class Name is unique in a Conceptual Model.
    - Attribute Name is unique in its Class (but not in a Conceptual Model)

Validation Types

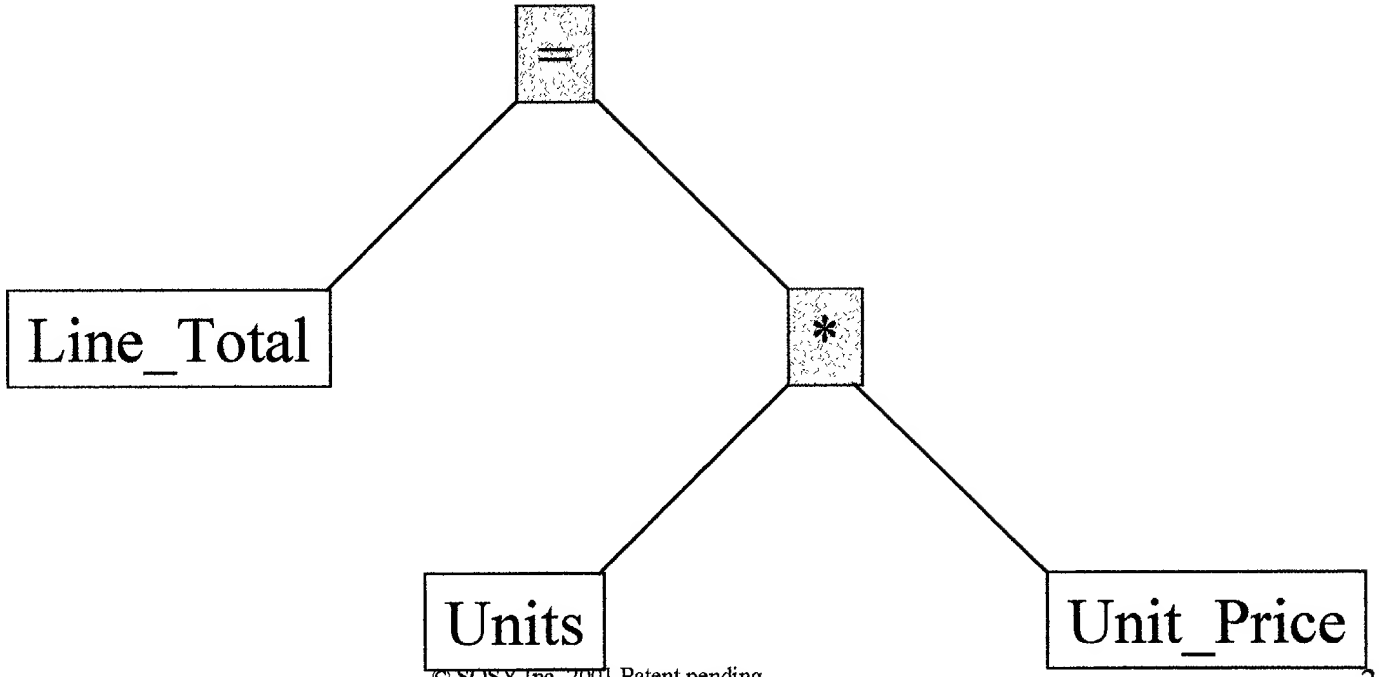
- Formulas of the Conceptual Model
  - Ensure the formulas of the Conceptual Model are correct and complete.
  - Syntactical and Semantical Validation according to an extended Formal Specification Language grammar.
  - Input:
    - Formula expression
    - Formula Type (precondition, valuation, …etc.)
    - Formula Context (class name, service name, …etc.)
  - Output:
    - Error Message (validation did not pass)
    - Validation Tree (validation passed)

Validation Trees

- Binary Tree representation of a correct formula.
- Tree consists of Nodes and Leaves.
- Nodes
  - Represent operators
  - Can have one or two "branches" (binary)
  - Branches can again be nodes or leaves
- Leaves
  - Represent operands
  - Have no branches

Example

- Line_Total = Units * Unit_Price



Documentation Translation

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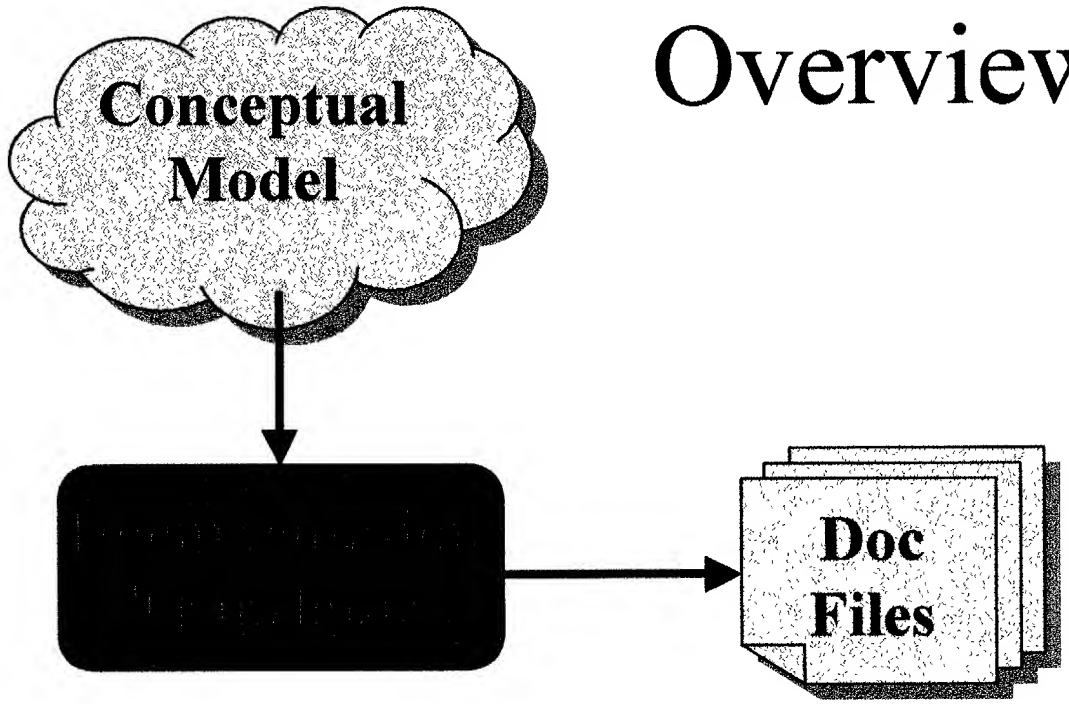
Index

- Intro
- Overview
- Output Detail
  - Document Types
  - Document Formats
- Translation
  - CM Subset of Interest
  - Translation Process
  - Remarks
- Example

Intro

- Documentation Translation is the process to obtain, from a Conceptual Model, documentation on the system it represents.
- Documentation can have several degrees of detail and be focused on different aspects, thus obtaining different documentation formats from the same Conceptual Model.

Overview



Document Type

- Help
- Full
- General
- User Help Manual
- Project Report
- Test Report

Document Format

- Multifile HTML
- Single File HTML
- ASCII Text
- LaTeX
- RTF
- Compiled HTML

Output Detail

- Document Types
  - Help
    - Description of each Class, its Attributes, Services and Population Selection Filters.
  - Full
    - Full description of a Conceptual Model
    - Aimed at analysts.
  - General
    - Description of each Class Attributes, Identification Function, Services, Aggregation Relationships and Specialization Relationships.

Output Detail

- Document Types
  - User Help Manual
    - Both Help Manual and Contextual Help (F1 key).
    - Intended for Operation Manual.
    - Integration with User Interface applications.
  - Project Report
    - Description of each Class Attributes and Services.
  - Test Report
    - Description of each Class Services.
    - Intended for Testing purposes.

Output Detail

- Document Formats
  - Multifile HTML
    - One HTML page per concept.
    - Recommended for navigable help.
  - Single File HTML
    - One single HTML page.
    - Recommended for printing.
  - ASCII Text
    - Single, plain ASCII text file.

Output Detail

- Document Formats
  - LaTeX
    - Single, LaTeX text file.
  - RTF
    - Single, RTF text file.
  - Compiled HTML
    - Same as Multifile HTML plus header files to be used by HTML Help Workshop compiler.
    - Recommended for contextual help.
    - Searching and Indexing facilities usage from browsers.

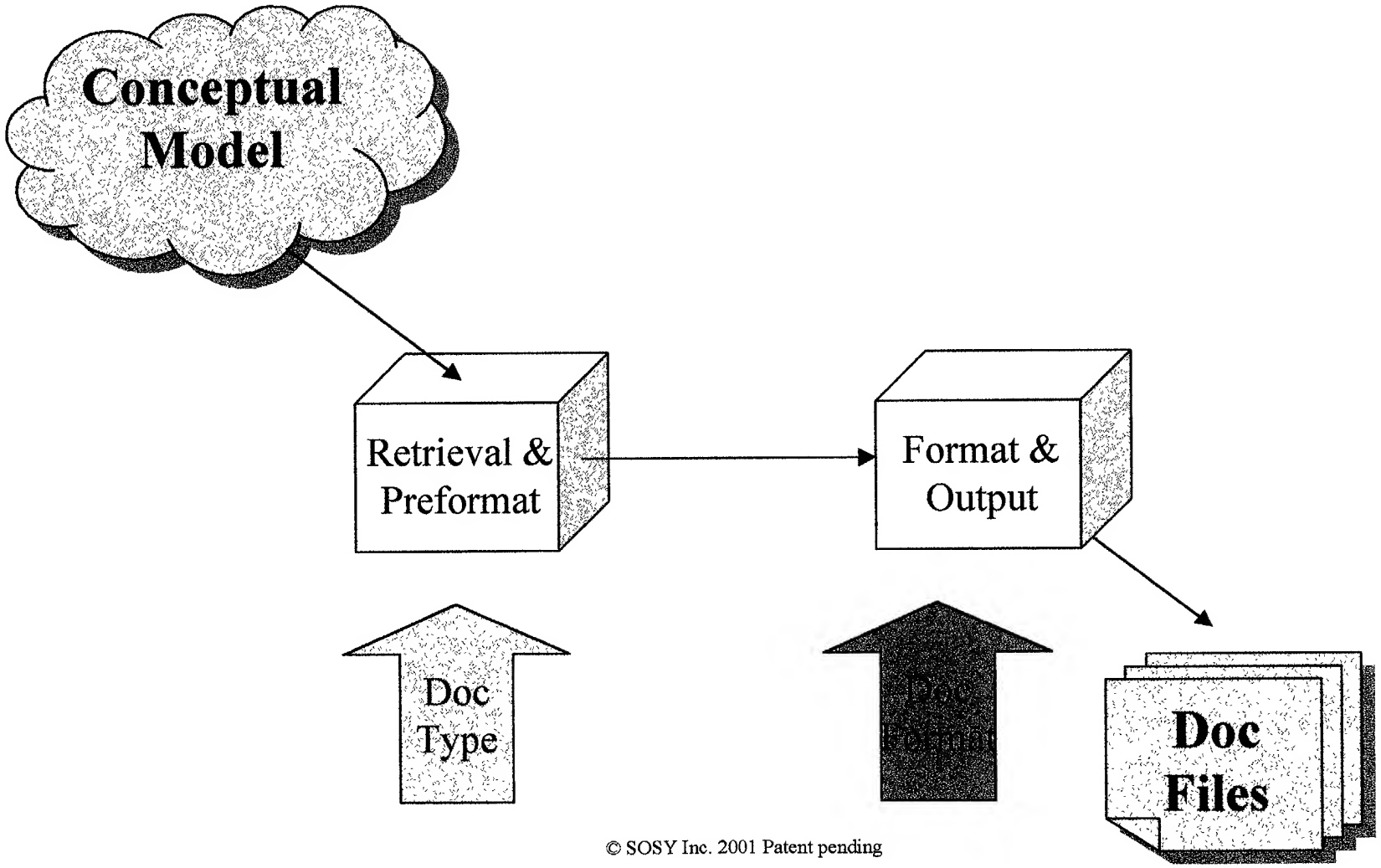
Translation

- Conceptual Model Subset of Interest
  - Subset of Interest depends on Document Type.
  - Usual elements:
    - Classes
    - Attributes
    - Relationships
    - Services & Arguments
  - Intensive use of analysis information.

Translation

- Translation Process
  - Read information from Conceptual Model and format it for output.
  - Two phases:
    - Information retrieval and pre-formatting.
      - Depends on Document Type
      - Independent from Document Format
    - Information output.
      - Depends on Document Format.
      - Independent from Document Type.

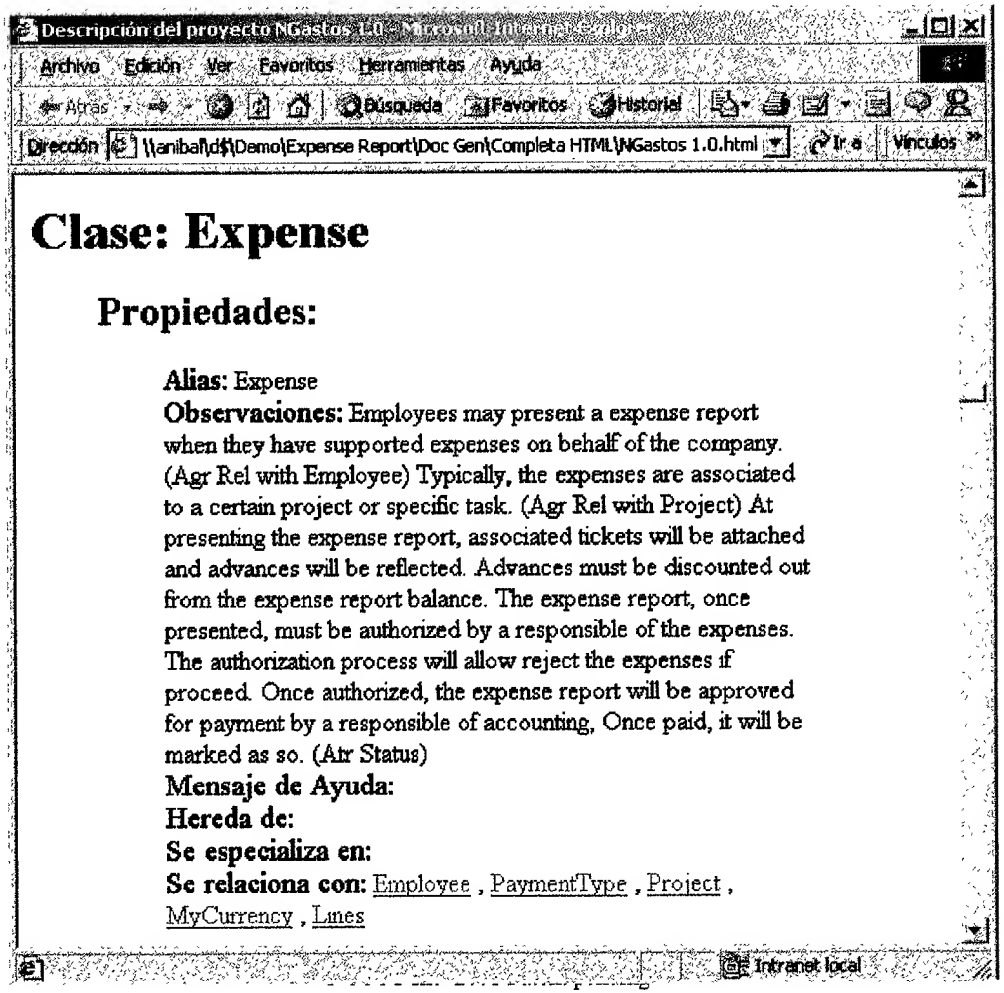
Translation Phases



Translation

- Remarks
  - Conceptual Model needs not to be valid (in terms of completeness and correctness) but it is always non-ambiguous.
  - The richer the analysis information, the richer the documentation.
  - Easily extensible
    - New Document Types
    - New Document Formats

Example



Persistence Relational Database Translation

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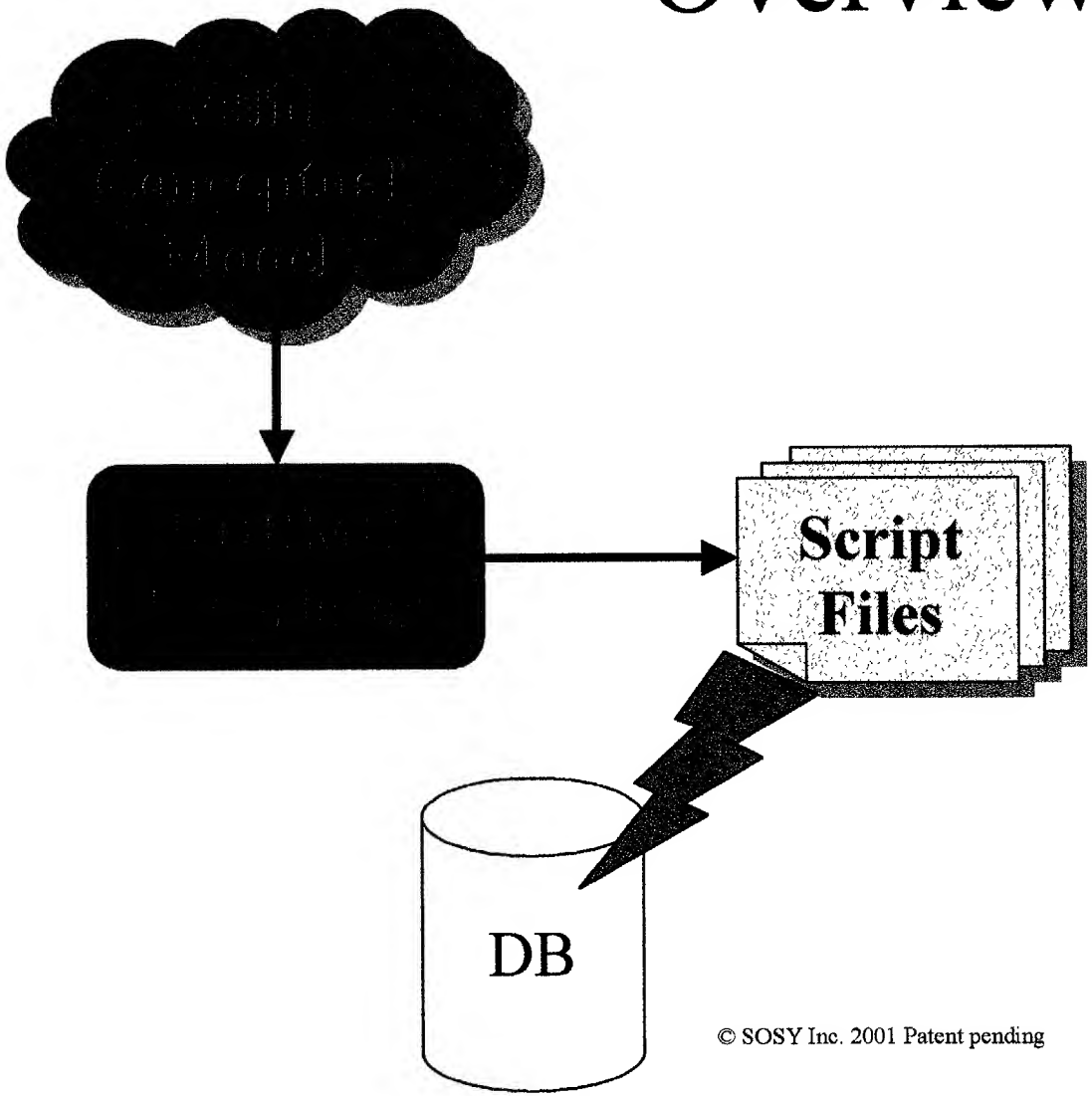
Index

- Intro
- Overview
- Output Detail
- Translation
  - CM Subset of Interest
  - Translation Processes
- Example

Intro

- Persistence Relational Database Translation is the process of creating a Relational Database from a certain subset of information in the Object Model of a valid Conceptual Model.
- Output script files are used to create a relational database using structured query language (SQL).

Overview



- Creates
- Primary Keys
- Foreign Keys
- Indexes
- Drop Creates
- Drop Primary Keys
- Drop Foreign Keys
- Drop Indexes

Output Detail

- Creates
  - Creation of Tables and Fields
- Primary Keys
  - Creation of Primary Keys as constraints on each table
- Foreign Keys
  - Creation of Foreign Keys as constraints on each table
- Indexes
  - Creation of Indexed on each table

Output Detail

- Drop Creates
  - Deletion of Tables
- Drop Primary Keys
  - Deletion of Primary Key Constraints
- Drop Foreign Keys
  - Deletion of Foreign Key Constraints
- Drop Indexes
  - Deletion of Indexes

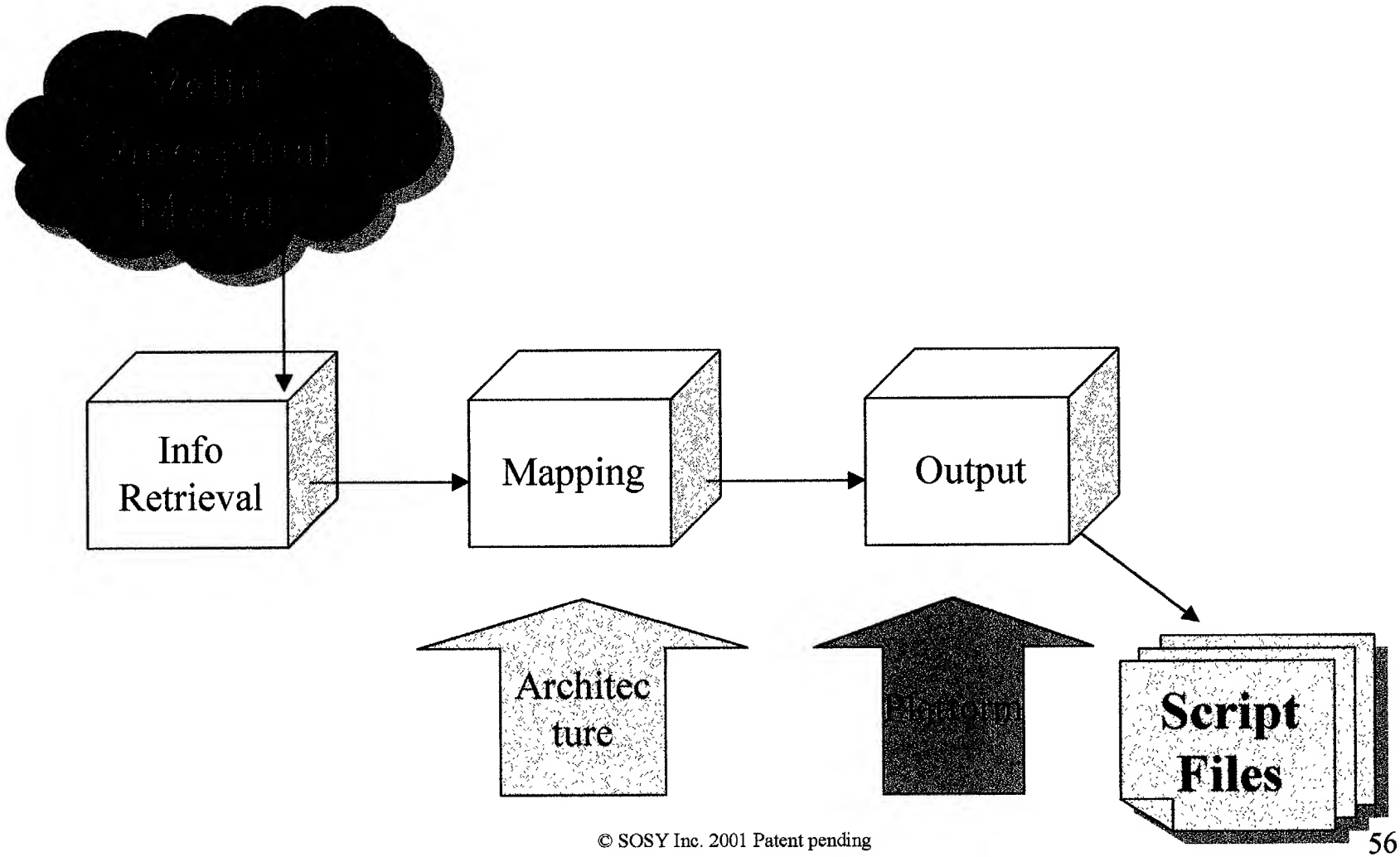
Translation

- Conceptual Model Subset of Interest
  - Object Model
    - Classes
    - Attributes
    - Identification Functions
    - Aggregation Relationships
    - Inheritance Relationships

Translation

- Three phases:
  - Information retrieval.
    - Independent from persistence architecture.
  - Fixed architecture mapping.
    - Depends on persistence architecture.
  - Information output.
    - Targeted for Standard ANSI SQL 92 RDBMS.
    - Script files depends on the platform's SQL syntax of RDBMS manufacturer.
    - May depend on platform specifications to make use of manufacturer extensions and tuning.

Translation Phases



Translation

- Translation Processes. Mapping:
  - Class → Table
  - Non-derived Attribute → Field
  - Identification Function → Primary Key
  - Univaluated Relationship →Foreign Key
  - Univaluated Relationship → Index
  - Multivaluated Relationship → Table
  - Inheritance Relationship →Foreign Key

Example

Create table script in SQL for Expense class


```
CREATE TABLE Expense (
        fk_Project_1 int NOT NULL ,
        id_Expense int NOT NULL ,
        fk_Employee_1 CHAR(10) NOT NULL ,
        fk_MyCurrency_1 CHAR(5) NOT NULL ,
        fk_PaymentType_1 CHAR(5) NULL ,
        PresentDate datetime NOT NULL ,
        Status int NOT NULL ,
        Cause VARCHAR(255) NOT NULL ,
        AuthoDate datetime NULL ,
        AuthoComments VARCHAR(255) NULL ,
        PaymentDate datetime NULL ,
        PayComments VARCHAR(255) NULL ,
        Advances DECIMAL(19,6) NOT NULL ,
        Exchange DECIMAL(19,6) NOT NULL);
```

Business Logic Translation

CARE Technologies, S.A.

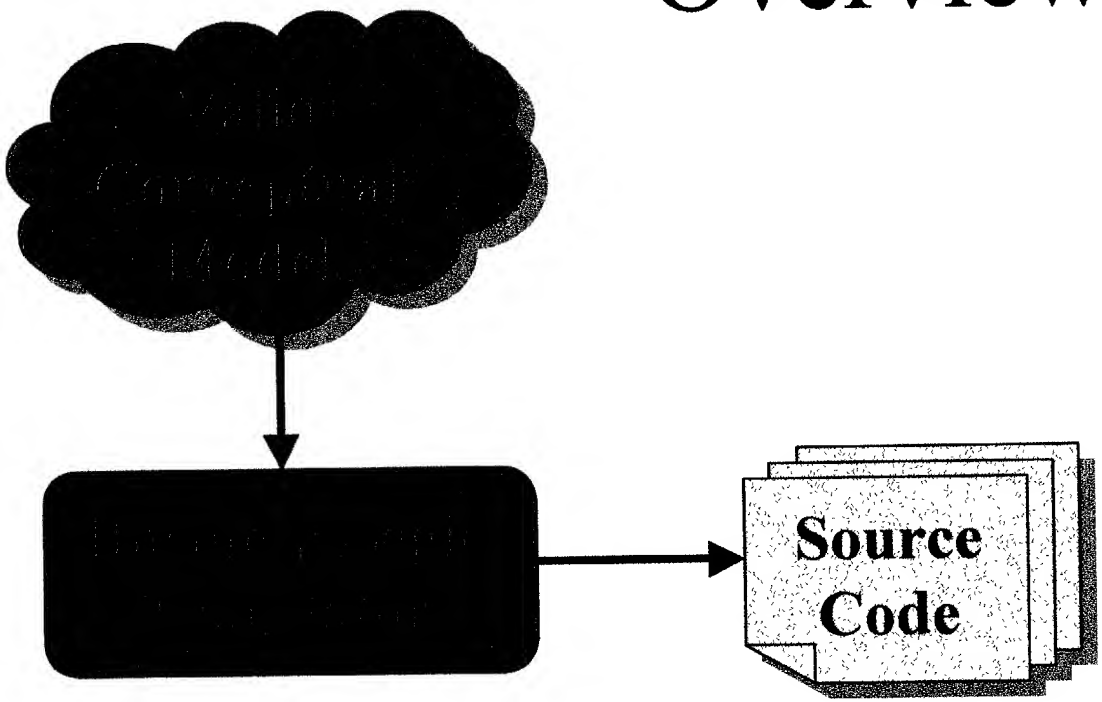
Index

- Intro
- Overview
- Output Detail
- Translation
  - CM Subset of Interest
  - Translation Processes
- Example

Intro

- Business Logic Translation is the process to obtain, following a precise Execution Model, the source code corresponding to the business logic from a valid Conceptual Model for a target Programming Language and Software Architecture.
- Execution Model is independent from Programming Language and Software Architecture.

Overview



Determines:

-Target Programming Language

-Target Software Architecture

Output Detail

- Target Programming Language and Software Architecture determine:
  - Source code organization in files
  - Files internal organization
- Source Code's backbone: Execution Model.

Output Detail

- Traceability: Source code highly readable and maintainable thanks to:
  - Source code is always organized and structured in the same way.
  - Naming conventions applied.
  - Source code includes analysis information from the Conceptual Model as comments.

Output Detail

- Implementation of a precise Execution Model grants Functional Equivalence with Conceptual Model.
- Programming Interface to Clients for:
  - Actor Validation and Authentication.
  - Services Execution.
  - Queries Execution.
- Manages:
  - Concurrency.
  - Transactions.
  - Interoperable Object Persistence.

Translation

- Conceptual Model Subset of Interest
  - Object Model
    - Static properties (Visibility & Persistence)
      - Attributes + Identification Functions
      - Derivations
      - Aggregation Relationships
      - Inheritance Relationships
    - Services (Execution Model)
      - Arguments
      - Preconditions
      - Transaction Formulas
    - Actors (Execution Model)
    - Integrity Constraints (Execution Model)

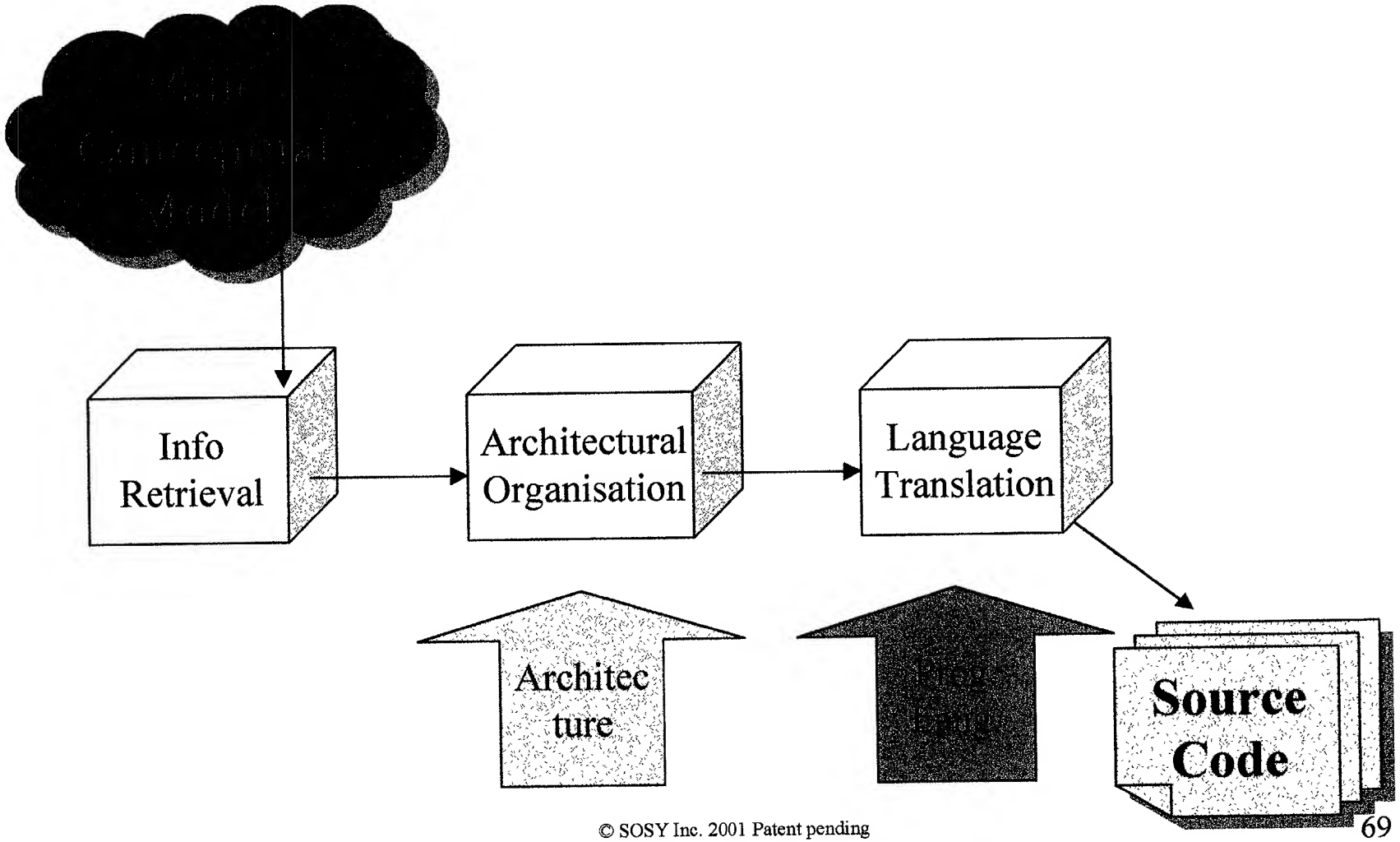
Translation

- Conceptual Model Subset of Interest.
  - Dynamic Model.
    - State Transition Diagram (Execution Model).
      - Controls Valid Lifes for an Object.
    - Object Interaction Diagram.
      - Triggers (Execution Model).
      - Global Transactions (Execution Model).
  - Functional Model (Execution Model).
    - Object state change upon occurrence of an event.

Translation

- Translation phases:
  - Information retrieval
    - Independent from target Software Architecture and Programming Language
  - Architectural organisation
    - Depends on target Software Architecture
    - Independent from target Programming Language
    - Determines files organisation and files internal structure
  - Language translation
    - Depends on target Programming Language
    - Influenced by Software Architecture
    - Takes advantage of Programming Language capabilities

Translation Phases



Translation

- Translation Processes
  - Classes
    - Static properties translation
    - Services translation
    - Queries translation
  - Global Interactions
    - Services translation
  - Global Functions
    - Functions Interface translation
    - Body is left blank

Example

- Evaluation:
  - Service Authorize modifies attributes Status, AuthoDate and AuthoComments
    - Formal Specification Language expression for evaluation

      Valuation

      [authorize ()] Status=2 and AuthoDate=today() and AuthoComments="";

    - Visual Basic Produced

```
Private Function MV_Eval_Expense_authorize() As String
     Expense_Status = 2
     Expense_AuthoDate = today()
    Expense_AuthoComments = ""
    MV_Eval_Expense_authorize = ""
End Function
```

APPENDIX A

User Interface Translation

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United States Patent & Trademark Office

Office of Initial Patent Examination -- Scanning Division

Application deficiencies found during scanning:

☐ Page(s)_____of_____ were not present for scanning. (Document title)

☐ Page(s)_____of_____were not present for scanning. (Document title)

☑ ***Scanned copy is best available.*** Drawings and miscellaneous